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(56) Documents Cited

EP 0340542 A1 EP 0118618 A1 EP 0090073 A1

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(54) Vacuum cleaner odour filters

(57) Odour filters for vacuum cleaners, which can be located after the dust filter and before the turbine, comprise an air-permeable support which contains synthetically produced spherical activated carbon having a diameter of between 0.1 and 2 mm, or printed-on small spots of bonded powdered activated carbon having a diameter and a height of 0.2 to 1 mm.

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## VACUUM CLEANER ODOUR FILTER

The invention relates to an odour filter for vacuum cleaners.

5 When a vacuum cleaner is used, considerable odour problems often occur, which can be traced back to strong-smelling substances e.g. dog hairs or microorganisms. In particular after the vacuum cleaner has been idle for a relatively long period, the concentration of the strong-smelling substances in the  
10 filter bag increases, which are blown out within a very short space of time once the machine is switched on.

It is known to install odour filters in vacuum cleaners in order to avoid such odour problems. These filters, for the most part, contain activated carbon and are  
15 located at the air exit, i.e. after the turbine. Such after-filters are known, for example, from DE-OS 42 04 553.

It is imperative to arrange such filters after the turbine, because the activated carbon particles rub  
20 against each other during operation of the vacuum cleaner owing to the vibrations, and carbon dust is therefore formed. If the filter were to be located before the turbine, the carbon dust might ignite in the turbine. In addition to the formation of the carbon  
25 dust which passes into the space to be cleaned, with the known methods and devices already known the positioning of the filters after the turbine also has the disadvantage that the vacuum cleaner has to be equipped specially for this after-filter, and that owing to the  
30 increased air resistance the air in the vacuum cleaner

heats up more than without an after-filter, and thus reduces the efficiency of the activated carbon. Also, such filters do not have a very large cross-section, which in turn has an adverse effect on the air resistance and the adsorption capacity.

It is an object of the invention to provide an efficient odour filter for vacuum cleaners which can be installed before the turbine without combustible dusts being formed which might lead to a fire in the motor.

There is provided, according to the invention, an odour filter for vacuum cleaners which can be located after the dust filter and before the turbine and which contains synthetically produced spherical activated carbon (referred to hereinafter as "spherical carbon") having a diameter of between 0.1 and 2 mm, or printed-on small spots of "heap" or "pile" shape of bonded powdered activated carbon having a diameter and a height of 0.2 to 1 mm (referred to hereinafter as "printed carbon") on an air-permeable support.

In a preferred form, the spherical carbon has an internal surface area of at least 900 m<sup>2</sup>/g and is obtained by carbonisation and activation of ion-exchangers. Such spherical carbon is described, for instance, in DD-B 063 768, DE-A-43 04 026, DE-A-43 28 28, GB-B-1 525 420, GB-B-2 012 257, GB-A-2 025 385, GB-A-2 053 176, US-A-4 040 990, US-A-4 224 415, US-A-4 857 243 and US-A-4 957 897.

This spherical carbon has the particular advantages that firstly it is spherical and secondly it has a very hard surface. Owing to the spherical shape of the spherical carbon, the contact surfaces, if rubbing occurs as a result of vibrations, is extremely small compared with conventional activated carbon. The term "activated

carbon" is employed here to mean material carbonised and then activated as described below, the raw material being vegetable (wood, peat etc.) or animal (blood, bones). With the spherical carbon, furthermore  
5 practically no abrasion is produced owing to the hard surface.

Another advantage of using spherical carbon is that, in contrast with conventional activated carbon, it has no macropores but instead virtually only micropores.

10 Macropores have a diameter of between 100 and 50,000 nm; micropores, on the other hand, have only a diameter of 0.3 to 2 nm. Thus dust particles which are not retained by the dust filter cannot clog the micropores of the spherical carbon owing to their larger diameter; the  
15 adsorption capacity of the spherical carbon in relation to strong-smelling substances is retained for substantially longer than for activated carbon, since with the latter the macropores very quickly become clogged by the ultra-fine dust particles and only very  
20 few micropores are left.

The application of spherical carbon to an air-permeable support is described, for instance, in DE-A-33 04 349, DE-A-38 13 563, US-A-4 510 193 and EP-B-118 618.

25 Furthermore, all other abrasion-resistant granular and moulded carbons, in particular those having an inner surface area of more than 900 m<sup>2</sup>/g, can also be used.

In the case of printed carbon, this may have a particle size of 0.1 to 50 µm, preferably 3 to 10 µm. The printed carbon may furthermore have a binder content of  
30 20 to 100 parts by weight, relative to the powdered activated carbon. The binder in this case may be a polyacrylate. The printed carbon and a method for the preparation thereof are described, for instance, in EP-B-090 073 and US-A-4 558 187.

The printed carbon spots which are "heap" or "pile" shaped have the particular advantages that the contact surface is practically negligible owing to the "heap shape", since the spots do not rub against each other even in the event of strong vibrations.

Furthermore, the distance between the individual spots can be set accurately to a predetermined value by corresponding templates of a rotary screen-printing installation.

The printed carbon, just like the spherical carbon, has a very hard surface and is thus very abrasion-resistant. For this reason, no dangerous carbon dust can be produced. Another advantage when using the printed carbon is the relatively good lack of sensitivity to rock dust.

In a preferred embodiment, the odour filter is designed as a bag which surrounds the dust filter. The dust filter, which in most vacuum cleaners is made of paper, is usually glued by its inlet opening to a cardboard ring or a piece of cardboard with a circular opening, which is pushed into a holder. This bag may be formed such that it can be pulled over the filter bag and can be constricted somewhat, for instance with an adhesive tape or a hook-and-pile fastener, behind the inlet opening of the paper bag. This substantially increases the surface area of the filter which reduces the air resistance and increases the adsorption capacity. The odour filter can furthermore be re-used after emptying or removing the dust filter.

The air-permeable support may be selected from the group consisting of paper or textile fabrics, such as woven fabrics, knitted fabrics or bonded fibre fabrics.

The spherical carbon may be fixed to the air-permeable support by means of an adhesive. This adhesive can be applied to the air-permeable material in dots. In particular, by a special arrangement of these dots of adhesive, the individual spherical carbon particles can be applied at sufficient distance from each other that they cannot touch each other at all.

The adhesive may however also cover the fibres of a wide-meshed knitted fabric or non-woven fabric. To this end, the adhesive is applied all-over to the air-permeable material, is squeezed off and optionally blown through the free points of the air-permeable material by means of a suitable device, preferably a slot nozzle. This blowing-through destroys the "windows". Then these fibres are laden with spherical carbon.

A low-solvent dual-component system, preferably a prepolymeric low-solvent system, may be used as the adhesive. The latter have a good initial adhesion and mostly have a marked minimum viscosity during the cross-linking phase, which results in optimum adhesion. Prepolymeric low-solvent systems are supplied, for instance, by Bayer AG under the name "High Solids". The adhesive is preferably applied in an excess to the air-permeable material and squeezed off, then the material is sprinkled with spherical carbon and the adhesive is cured.

In a further embodiment, the air-permeable support is laden on both sides with the spherical carbon or the printed carbon. In this case, carbon coatings of up to 500 g/m<sup>2</sup> can be achieved.

In a preferred embodiment, the spherical carbon or printed carbon covers 30 to 70% the surface of the support.

5 In another embodiment, the odour filter is located before the suction slots of the filter space, i.e. the space in which the dust filter is located, preferably as a textile fabric or in strip form. In particular, it may be a large-pored, reticulated polyurethane foam laden with spherical carbon. The spherical carbon may  
10 preferably be incorporated in the polyurethane foam, for instance in accordance with DE-A-38 13 563.

15 In another embodiment, an ultra-fine dust filter is additionally arranged before the odour filter, the function of which former filter is to retain the ultra-fine dust which passes through the filter bag. The ultra-fine dust filter may be in particular an HEPA filter (= high efficiency particle arrestance filter).

Claims

1. An odour filter for vacuum cleaners, which can be located between the dust filter and the turbine of a vacuum cleaner and which comprises either synthetically produced spherical activated carbon having a diameter of between 0.1 and 2 mm or printed-on small spots of bonded powdered activated carbon having a diameter and a height of 0.2 to 1 mm on an air-permeable support.
2. An odour filter as claimed in wherein the spherical carbon has an internal surface area of at least 900 m<sup>2</sup>/g.
3. An odour filter as claimed in either Claim 1 or 2, wherein the spherical carbon is produced by carbonisation and activation of ion-exchangers.
4. An odour filter as claimed in any preceding claim wherein the spherical carbon covers 30 to 70% of the surface of the laminar support.
5. An odour filter as claimed in any preceding claim wherein the spherical carbon is fixed to the air-permeable support by means of an adhesive.
6. An odour filter as claimed in Claim 5, characterised in that the adhesive is applied to the air-permeable support in dots.
7. An odour filter as claimed in either Claim 5 or Claim 6 wherein the adhesive is a low-solvent dual-component system, preferably a prepolymeric low-solvent system, which has minimum viscosity during cross-linking.

8. An odour filter as claimed in Claim 1 wherein the powdered activated carbon has a particle size of 0.1 to 50 $\mu$ m, preferably 3 to 10 $\mu$ m.

5 9. An odour filter as claimed in either Claim 1 or 8 wherein the powdered activated carbon has a binder content of 20 to 100 parts by weight, relative to the powdered activated carbon.

10. An odour filter as claimed in any one of Claims 1, 8 and 9 wherein the binder is a polyacrylate.

10 11. An odour filter as claimed in any one of Claims 1 and 8 to 10 wherein powdered activated carbon covers 30 to 70% of the surface of the laminar support.

15 12. An odour filter as claimed in any preceding claim wherein the filter is designed as a bag which surrounds the dust filter.

20 13. An odour filter as claimed in any preceding claim wherein the air-permeable support is selected from the group consisting of paper or textile fabrics, such as woven fabrics, knitted fabrics or bonded fibre fabrics.

14. An odour filter as claimed in Claim 13 when dependent on either Claim 6 or Claim 7 wherein the adhesive covers the fibres of a wide-meshed knitted fabric or non-woven fabric.

25 15. An odour filter as claimed in any preceding claim wherein the filter is locatable before the suction slots of the cleaner filter space and preferably comprises a textile fabric or is in strip form.

16. An odour filter as claimed in any one of Claims 1 to 4 or 15 wherein the odour filter is a large-pored, reticulated polyurethane foam laden with spherical carbon.

5 17. A filter comprising an odour filter as claimed in any preceding claim and an ultra-fine dust filter arranged before the odour filter.

18. A filter as claimed in Claim 17 wherein the ultra-fine dust filter is an HEPA filter.

**Relevant Technical Fields**

- (i) UK Cl (Ed.N)      B1L (LAE, LDB, LDD)  
(ii) Int Cl (Ed.6)      B01D 53/00, 53/02, 53/04

**Databases (see below)**

- (i) UK Patent Office collections of GB, EP, WO and US patent specifications.

- (ii) ONLINE: WPI

**Search Examiner**  
**P N DAVEY**

**Date of completion of Search**  
**22 JUNE 1995**

**Documents considered relevant following a search in respect of Claims :-**  
**1-18**

**Categories of documents**

- |           |   |               |   |
|-----------|---|---------------|---|
| <b>X:</b> | Document indicating lack of novelty or of inventive step.   | <b>P:</b>     | Document published on or after the declared priority date but before the filing date of the present application.        |
| <b>Y:</b> | Document indicating lack of inventive step if combined with one or more other documents of the same category. | <b>E:</b>     | Patent document published on or after, but with priority date earlier than, the filing date of the present application. |
| <b>A:</b> | Document indicating technological background and/or state of the art.   | <b>&amp;:</b> | Member of the same patent family; corresponding document.   |

Category	Identity of document and relevant passages	Relevant to claim(s)
X,Y	WO 91/11247 A1 (VON BLUCHER) see eg Claims 1 and 6	1 at least
X,Y	EP 0340542 A1 (VON BLUCHER) see eg Claims 1 and 12	1 at least
X,Y	EP 0118618 A1 (VON BLUCHER) see eg Claim 7	1 at least
X,Y	EP 0090073 A1 (VON BLUCHER) see eg Claim 8	1 at least
Y	WPI Abstract Accession No 93-265567/34 and DE 004204553 A1 (MIELE)	1 at least

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